

A SYSTEM FOR SEAWATER DESALINATION AND A POWERING METHOD IN ASSOCIATION THEREWITH

5 TECHNICAL FIELD OF THE INVENTION

The present invention relates to a system and a powering method in relation to seawater desalination wherein one or more portions of the system can be one or both of directly and indirectly powered by wind.

10 BACKGROUND OF THE INVENTION

To overcome water shortage, desalination of sea-water has been considered. In general, desalination relates to removal of dissolved salts and minerals from seawater to produce potable water.

15 However, removal of dissolved salt and minerals from seawater would consume a large amount of energy. Such large consumption of energy would not be environmentally friendly.

Conventional techniques such as reverse osmosis followed by multi-stage
20 flash and multi-effects distillation systems have been considered to reduce energy consumption. However, membranes used for reverse osmosis are often not durable and could lead to high wastage as well as difficulties in implementation and/or maintenance in a seawater desalination system.

25 Therefore, conventional techniques may not facilitate reduction of energy consumption in a seawater desalination system in an efficient manner and/or implementation/maintenance friendly manner.

The present disclosure contemplates that there is therefore a need for a
30 solution which addresses, at least in part, one or more of the forgoing problems.

SUMMARY OF THE INVENTION

In accordance with an aspect of the present disclosure, there is provided a system which can be suitable for desalinating sea-water. At least a portion of
5 the system can be one or both of directly and indirectly powered by wind.

The system can include a drawing part where sea-water can be drawn in (i.e., into the system). The system can further include a first treatment part which can be configured to perform preliminary treatment of sea-water drawn in so
10 as to produce first stage treated sea-water. The system can yet further include a second treatment part which can be configured to receive and process first stage treated sea-water to produce second stage treated sea-water.

15 The second stage treated sea-water can be further communicated for further treatment for one or both of:

- 1) producing freshwater; and
- 2) material recovery.

20 The drawing part, the first treatment part and/or the second treatment part can be capable of being one or both of directly and indirectly powered by wind for operation (e.g., pumping to draw sea-water in, filtration based operation(s), aerating, atomizing, application of pressure, heating and/or ultrasonic atomization).

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In accordance with another aspect of the present disclosure, there is provided a powering method in association with a system which can be suitable for desalinating sea-water.

30 Specifically, the powering method 400 can relate to powering the system in a manner such that one or more portions of the system can be one or both of directly and indirectly powered by wind.

The powering method can include a harnessing step, a conversion step, a direct powering step, an indirect powering step and/or a cascaded powering step, according to an embodiment of the disclosure.

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BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the disclosure are described hereinafter with reference to the following drawings, in which:

10 Fig. 1 shows a system which can be suitable for desalinating sea-water, according to an embodiment of the disclosure;

Fig. 2 shows the system of Fig. 1 in further detail, according to an embodiment of the disclosure;

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Fig. 3 shows an exemplary scenario in connection with the system of Fig. 1, according to an embodiment of the disclosure; and

20 Fig. 4 shows a powering method in association with the system of Fig. 1, according to an embodiment of the disclosure.

DETAILED DESCRIPTION

25 The present disclosure contemplates the use of wind energy for sea-water desalination. More specifically, the present disclosure contemplates a system suitable for desalinating sea-water and at least a portion of the system can be one or both of directly and indirectly powered by wind.

30 The present disclosure contemplates the utilization of wind energy because wind can be considered one of the greenest energies which can be easily available. Moreover, utilizing wind energy can simplify system configuration of a seawater desalination system in that complex powering configurations and/or elements such as the aforementioned membrane(s) for reverse

osmosis can be omitted. Accordingly, implementation and/or maintenance friendliness can be facilitated. Moreover, a wind powered seawater desalination system can be operated in places with wind – accordingly, the system can be conveniently/flexibly applied in various terrain environment(s) as appropriate.

The foregoing will be discussed in further detail with reference to Fig. 1 to Fig. 4 hereinafter.

Referring to Fig. 1, a system 100 is shown according to an embodiment of the disclosure. The system 100 can be suitable for desalinating sea-water. Moreover, at least a portion of the system 100 can be one or both of directly and indirectly powered by wind.

The system 100 can include a source portion 102, a power portion 104, a processing portion 106 and an output portion 108.

The source portion 102 can be coupled to the power portion 104. The power portion 104 can be coupled to the processing portion 106. The processing portion 106 can be coupled to the output portion 108.

The source portion 102 can be configured to harness wind energy for one or both of direct and indirect powering by wind for enabling one or more operations at the processing portion 106.

Indirect powering by wind for operation can, for example, be by manner of converting wind energy into an energy type (e.g., electrical power/electricity) suitable for powering/driving at least a portion of the power portion 104. One or more portions of the power portion 104 can, in turn, be configured to power/drive one or more portions of the processing portion 106 in a manner so as to enable one or more operations associated with one or more portions of the processing portion 106.

Direct powering by wind for operation can, for example, be by manner of harnessing wind energy for powering/driving at least a portion of the power portion 104. The portion(s) of the power portion 104 can be powered/driven
5 (i.e., by manner of harnessed wind energy) in a manner so as to produce an energy type (e.g., mechanical energy/kinetic energy) suitable for driving/powering one or more portions of the processing portion 106 in a manner so as to enable one or more operations associated with one or more portions of the processing portion 106.

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In this regard, the power portion 104 can be coupled to the source portion 102 in a manner so as to one or both of:

- 1) receive energy converted based on harnessed wind energy (i.e., in association with indirect powering by wind for operation); and
- 15 2) be driven by harnessed wind energy (i.e., in association with direct powering by wind for operation).

In general, the processing portion 106, when powered/driven, by the power portion 104, can be operated in a manner so as to draw sea-water from the sea and process the drawn sea-water to produce processed sea-water.
20 Processed sea-water can be communicated from the processing portion 106.

The output portion 108 can be configured to receive the processed sea-water for further processing in a manner so as to produce one or more output
25 products. Examples of an output product can include fresh-water and/or one or more recovered materials (e.g., chemicals/minerals).

Referring to Fig. 2, the system 100 is shown in further detail, according to an embodiment of the disclosure.

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The source portion 102 can include a wind power system 202, according to an embodiment of the disclosure. The wind power system 202 can include a

mechanical system 204. The wind power system 202 can further include a generator system 206, according to an embodiment of the disclosure. The mechanical system 204 can, in one embodiment, be coupled to the generator system 206.

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The mechanical system 204 can correspond to a wind energy harnessing system which can include movable portion 204a shaped and dimensioned to be moved based on wind, and a translator portion 204b. The movable portion 204a can be coupled to the translator portion 204b. In operation, the movable portion 204a can be moved based on wind and the translator portion 204b can be configured to translate movement of the movable portion 204a into, for example, mechanical energy.

The generator system 206 can correspond to, for example, a power/an electricity generating system which can be configured to, for example, generate electrical power/electricity based on the aforementioned translated mechanical energy from the translator portion 204b.

In this regard, the wind power system 202 can correspond to, for example, a wind turbine system or a windmill system. The movable portion 204a can correspond to, for example, blades of a wind turbine system which can be spun based on wind. Specifically, the movable portion 204a (e.g., blades) can be moved based on wind's kinetic energy. The translator portion 204b can correspond to, for example, an actuator. Specifically, the actuator can be coupled to the blades. In this regard, it is appreciable that kinetic energy from wind can be converted to/translated into mechanical energy. Moreover, in one embodiment, the generator system 206 can be coupled to the translator portion 204b. Therefore, based on mechanical energy from the translator portion 204b, the generator system 206 can be configured to generate, for example, power/electricity.

In one embodiment, the mechanical system 204 can be coupled to the power portion 104. In another embodiment, the generator system 206 can be coupled to the power portion 104. In yet another embodiment, the mechanical system 204 and the generator system 206 can be coupled to the power portion 104.

In this regard, it is appreciable that the power portion 104 can be one or both of electrically coupled and mechanically coupled to the source portion 102.

10 Additionally, as mentioned earlier, the power portion 104 can be coupled to the source portion 102 in a manner so as to one or both of:

- 1) receive energy converted based on harnessed wind energy (i.e., in association with indirect powering by wind for operation); and
- 2) be driven by harnessed wind energy (i.e., in association with direct powering by wind for operation).

In this regard, direct powering by wind for operation can, for example, be by manner of mechanical coupling between the source portion 102 and the power portion 104, according to an embodiment of the disclosure.

20 Specifically, the translator portion 204b can be coupled to the one or more portions of the power portion 104 according to an embodiment of the disclosure. More specifically, one or more portions of the power portion 104 can be coupled to the translator portion 204b by, for example, manner of mechanical coupling so as to be capable of being driven by the translator portion 204b for generating power/electricity in analogous manner as discussed earlier with reference to the generator system 206.

Power/electricity generated by one or more portions of the power portion 104 can be communicated to one or more portions of the processing portion 106 for facilitating/enabling one or more operations associated with one or more portions of the processing portion 106. This will be discussed later in further detail.

Furthermore, indirect powering by wind for operation can, for example, be by manner of electrical coupling between the source portion 102 and the power portion 104, according to an embodiment of the disclosure. Specifically, the generator system 206 can be coupled to one or more portions of the power portion 104, according to an embodiment of the disclosure. More specifically, one or more portions of the power portion 104 can be coupled to the generator system 206 by, for example, manner of electrical coupling so as to be capable of being supplied with power/electricity.

One or more portions of the power portion 104 can be powered with supplied power/electricity from the generator system 206 so as to facilitate/enable the driving of one or more operations associated with one or more portions of the processing portion 106. This will be discussed later in further detail.

Yet furthermore, the source portion 102 and the power portion 104 can be coupled by manner of a combination of both mechanical coupling and electrical coupling so as to allow one or more portions of the power portion 104 to be supplied power/electricity from the generator system 206 and to be driven by the translator portion 204b. Therefore, one or more operations associated with the processing portion 106 can be based on a combination of direct powering by wind and indirect powering by wind.

In this regard, the power portion 104 can include one or more portions that can be one or both of directly powered by wind and indirectly powered by wind. Therefore, it is appreciable that the power portion 104 can include one or more power portions, according to an embodiment of the disclosure. The power portion can further include one or more driver portions, according to an embodiment of the disclosure.

In one embodiment, the power portion 104 can, for example, include a first power portion corresponding to a first supply part 208, a second power portion

corresponding to a second supply part 210 and/or a third power portion corresponding to a third supply part 212. The power portion 104 can, for example, further include a first driver portion 213a and/or a second driver portion 213b.

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In this regard, in relation to the power portion 104, the aforementioned one or more power portions can correspond to one or more supply parts. Moreover, one or more of the supply parts (e.g., the first supply part 208, the second supply part 210 and/or the third supply part 212) can be coupled to one or
10 more of the driver portions (e.g., the first driver portion 213a and/or the second driver portion 213b). Furthermore, one or more supply parts (i.e., the first supply part 208, the second supply part 210 and/or the third supply part 212) can, in one embodiment, be associated with one or more portions of the processing portion 106.

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Therefore, one or more supply parts (i.e., the first supply part 208, the second supply part 210 and/or the third supply part 212) of the power portion 104 can be configured to one or both of directly and indirectly power/drive one or more portions of the processing portion 106 for facilitating/enabling one or more
20 operations associated with one or more portions of the processing portion 106.

In one embodiment, the first supply part 208, the second supply part 210 and/or the third supply part 212 can be configured to directly power/drive one
25 or more portions of the processing portion 106 by manner of direct coupling. For example, the first supply part 208, the second supply part 210 and/or the third supply part 212 can be directly coupled to one or more portions of the processing portion 106.

30 In another embodiment, the first supply part 208, the second supply part 210 and/or the third supply part 212 can be configured to indirectly power/drive one or more portions of the processing portion 106 by manner of indirect

coupling. For example, the first supply part 208, the second supply part 210 and/or the third supply part 212 can be coupled to one or more driver portions (e.g., first driver portion 213a and/or the second driver portion 213b) which can, in-turn, be coupled to one or more portions of the processing portion 106.

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In yet another embodiment, one or more supply parts ((i.e., the first supply part 208, the second supply part 210 and/or the third supply part 212) can be directly coupled to one or more portions of the processing portion 106. Moreover, one or more supply parts ((i.e., the first supply part 208, the second supply part 210 and/or the third supply part 212) can be coupled to one or more driver portions (e.g., first driver portion 213a and/or the second driver portion 213b) which can, in-turn, be coupled to one or more portions of the processing portion 106.

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15 In this manner, the power portion 104 can generally be configured to one or both of directly and indirectly power/drive one or more portions of the processing portion 106 for facilitating/enabling one or more operations associated with one or more portions of the processing portion 106.

20 Appreciably, the processing portion 106 can include one or more portions which can be associated with one or more operations. Therefore, it is appreciable that the processing portion 106 can include one or more processing portions and each processing portion can be associated with one or more operations, according to an embodiment of the disclosure.

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In one embodiment, the processing portion 106 can, for example, include a first processing portion corresponding to a first processing part 214, a second processing portion corresponding to a second processing part 216 and/or a third processing portion corresponding to a third processing part 218. In this regard, in relation to the processing portion 106, the aforementioned one or more processing portions can correspond to one or more processing parts.

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Generally, sea-water can be drawn from the sea and processed by one or more processing parts (e.g., the first processing part 214, the second processing part 216 and/or the third processing part 218) to produce processed sea-water.

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Earlier mentioned, the output portion 108 can be configured to receive the processed sea-water for further processing in a manner so as to produce one or more output products. Examples of an output product can include fresh-water and/or one or more recovered materials (e.g., chemicals/minerals).

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In this regard, the output portion 108 can include one or more further processing parts, according to an embodiment of the disclosure. For example, the output portion 108 can include a primary further processing part 221 and one or both of a first secondary further processing part 220 and a second secondary further processing part 222.

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Processed sea-water can, for example, be communicated to the primary further processing part 221 and the first secondary further processing part 220 for further processing to produce a first output product 224 (e.g., fresh-water).

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Processed sea-water can, for example, be communicated to the primary further processing part 221 and the second secondary processing part 222 for further processing to produce a second output product 226 (e.g., a recovered material).

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The foregoing will be discussed in further detail based on an exemplary scenario hereinafter.

Referring to Fig. 3, an exemplary scenario 300 in connection with the system 100 is shown, according to an embodiment of the disclosure.

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In the exemplary scenario 300, the source portion 102 can correspond to a wind power system 202.

5 Earlier mentioned, the wind power system 202 can include a mechanical system 204 and/or a generator system 206. Moreover, the mechanical system 204 can include a movable portion 204a (e.g., blades) and/or a translator portion 204b (e.g., actuator).

10 Additionally, in the exemplary scenario 300, the power portion 104 can include at least one of a first supply part 208, a second supply part 210 and a third supply part 212. The power portion 104 can further include at least one of a first driver portion 213a and a second driver portion 213b.

15 The first supply part 208 can, for example, correspond to a mechanical based supply part, according to an embodiment of the disclosure. The mechanical based supply part can, for example, correspond to a mechanical device such as a pump. The wind power system 202 can be coupled to the first supply part 208 by manner of mechanical coupling such that the mechanical device (e.g., pump) can be operationally driven by wind energy harnessed by the
20 wind power system 202. Specifically, the first supply part 208 can, for example, be mechanically coupled (not shown) to the mechanical system 204 and be driven by the mechanical system 204. More specifically, the first supply part 208 can, for example, be mechanically coupled directly (not shown) to the translator portion 204b.

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The second supply part 210 can, for example, correspond to an electromechanical based supply part, according to an embodiment of the disclosure. The electromechanical based supply part can, for example, correspond to an electricity generating system which can include a
30 mechanical portion (not shown) and a generator portion (not shown). The mechanical portion can be coupled to the generator portion. The mechanical portion can be coupled (not shown) to wind power system 202 in a manner

such that the mechanical portion can be operationally driven by wind energy harnessed by the wind power system 202 in a manner so as to, in-turn, drive the generator portion for producing power/electricity. The wind power system 202 can be coupled to the second supply part 210 by manner of mechanical coupling such that the electromechanical device (e.g., electricity generating system) can be operationally driven by wind energy harnessed by the wind power system 202. Specifically, the second supply part 210 can, for example, be mechanically coupled (not shown) to the mechanical system 204 and be driven by the mechanical system 204. More specifically, the second supply part 210 can, for example, be mechanically coupled directly (not shown) to the movable portion 204a.

The third supply part 212 can, for example, correspond to an electricity based supply part, according to an embodiment of the disclosure. The electricity based supply part can, for example, correspond to an electrical device capable of being powered by power/electricity received from the wind power system 202 to produce energy for facilitating/driving one or more operations associated with the processing portion 106. For example, the electrical device can correspond to an air compressor. Operationally, the air compressor can be powered by power/electricity received from the wind power system 202 to produce compressed air. The wind power system 202 can be coupled to the third supply part 212 by manner of electrical coupling such that the electrical device (e.g., air compressor) can be operationally powered based on energy converted based on wind energy harnessed. Specifically, the third supply part 212 can, for example, be electrically coupled (not shown) to the generator system 206 and be powered by the generator system 206. More specifically, the third supply part 212 can, for example, be electrically coupled directly (not shown) to the generator portion 206.

The first driver portion 213a can, for example, correspond to an ultrasonic type driver portion which can include an ultrasonic generator part 213c and an ultrasonic atomization part 213d, according to an embodiment of the

disclosure. The ultrasonic generator part 213c can be coupled to the ultrasonic atomization part 213d.

5 The second driver portion 213b can, for example, correspond to a heating type driver portion which can include a first heat exchanger part 213e and a second heat exchanger part 213f, according to an embodiment of the disclosure. The first heat exchanger part 213e can be coupled to the second heat exchanger part 213f.

10 Furthermore, in the exemplary scenario 300, the processing portion 106 can include at least one of a first processing part 214, a second processing part 216 and a third processing part 218.

15 The first processing part 214 can include/can correspond to a drawing part 302 where sea-water can be drawn into the system 100 from the sea. As an option, at the drawing part 302, geothermal hot water can be drawn into the system 100. In this regard, at the drawing part 302, one or both of sea-water and geothermal hot water can be drawn (i.e., into the system 100). As shown, in one embodiment, the drawing part 302 can include one or both of a sea-
20 water drawing part 302a in association with the drawing of sea-water from sea and a hot-water drawing part 302b in association with the drawing of geothermal hot water.

25 The second processing part 216 can include/can correspond to a first treatment part 304 which can include, for example, a pre-treatment part 304a and/or an aeration part 304b, according to an embodiment of the disclosure. As shown, the pre-treatment part 304a can be coupled to the aeration part 304b.

30 The third processing part 218 can include/can correspond to a second treatment part 306 which can include, for example, a pressure tank part 306a and/or an ultrasonic twin-fluid atomization part 306b, according to an

embodiment of the disclosure. As shown, the pressure tank part 306a can be coupled to the ultrasonic twin-fluid atomization part 306b.

Moreover, in the exemplary scenario 300, the output portion 108 can include a
5 primary further processing part 221 and at least one of a first secondary
further processing part 220 and a second secondary further processing part
222. The primary further processing part 221 can include/correspond to a
flash distillation part 307, according to an embodiment of the disclosure. The
first secondary further processing part 220 can include a filtration part 308 and
10 the second secondary further processing part 222 can include a condensation
part 310, according to an embodiment of the disclosure. The flash distillation
part 307 can be coupled to one or both of the filtration part 308 and the
condensation part 310.

15 In the exemplary scenario 300, the wind power system 202 can generally be
coupled to the first supply part 208, the second supply part 210 and/or the
third supply part 212 in a manner such that wind energy harnessed at the
wind power system 202 can be used for one or both of directly and indirectly
powering and/or driving, via the power portion 104, operation(s) associated
20 with the processing portion 106. Each of the first supply part 208, the second
supply part 210 and the third supply part 212 can, for example, be associated
with any one of the first processing part 214, the second processing part 216
and the third processing part 218, or any combination thereof.

25 Specifically, the first supply part 208 can be associated with at least one of the
first processing part 214, the second processing part 216 and the third
processing part 218. The second supply part 210 can be associated with at
least one of the first processing part 214, the second processing part 216 and
the third processing part 218. The third supply part 212 can be associated
30 with at least one of the first processing part 214, the second processing part
216 and the third processing part 218.

More specifically, the first supply part 208 can be coupled to the first processing part 214, the second processing part 216 and/or the third processing part 218. The second supply part 210 can be coupled, via the driver portion(s) (e.g., the first driver portion 213a and/or the second driver portion 213b), to the first processing part 214, the second processing part 216 and/or the third processing part 218. The third supply part 212 can be coupled to the first processing part 214, the second processing part 216 and/or the third processing part 218.

In one embodiment, the first supply part 208 can be directly coupled to the first processing part 214. The second supply part 210 can be indirectly coupled (i.e., via first driver portion 213a and/or the second driver portion 213b) to one or both of the second processing part 216 and the third processing part 218. The third supply part 212 can be directly coupled to the second processing part 216.

As shown, the first supply part 208 (e.g., a mechanical based supply part which can correspond to a mechanical device such as a pump) can be coupled to the drawing part 302. Specifically, the first supply part 208 can be coupled to one or both of the sea-water drawing part 302a and the hot-water drawing part 302b. In this regard, the wind power system 202 can be coupled to the first supply part 208 by manner of mechanical coupling such that the mechanical device (e.g., pump) can be operationally driven by wind energy harnessed by the wind power system 202 in a manner so as to draw, at the drawing part 302, one or both of sea-water from the sea and geothermal hot water from a geothermal hot water source.

Therefore, it is appreciable that the drawing part 302 can be considered to be directly powered by wind in the sense that the first supply part 208, to which the drawing part 302 is coupled, is driven by harnessed wind energy from the wind power system 202 to, in turn, drive the drawing part 302 to perform the

operation of drawing sea-water from the sea and/or perform the operation of drawing geothermal hot water.

5 As discussed earlier, the drawing part 302 can, for example, correspond to the first processing part 214 and sea-water (i.e., from the sea) can be drawn in (i.e., to the system 100), at the drawing part 302, for processing at the first treatment part 304.

10 The first treatment part 304 can be configured to receive sea-water drawn in by the drawing part 302 and process received sea-water in a manner so as to produce a first stage treated sea-water, as will be discussed in further detail hereinafter.

15 As shown, at the first treatment part 304, sea-water drawn in can be received by the pre-treatment part 304a for pre-treatment processing prior to further communication to the aeration part 304b for further processing to produce a first stage treated sea-water. The pre-treatment part 304a and the aeration part 304b can be coupled to the third supply part 212 (e.g., an electricity based supply part corresponding to an electrical device such as an air
20 compressor). Moreover, the aeration part 304b can be coupled to the second driver portion 213b (i.e., via the second heat exchanger part 213f) which can be coupled to the second supply part 210 (e.g., an electromechanical based supply part corresponding to an electricity generating system).

25 Operationally, the third supply part 212 can, as mentioned earlier, be powered by power/electricity received from the wind power system 202 to produce, for example, compressed air. Compressed air can be provided to the pre-treatment part 304a to drive filtration based operation(s) (sand filtration, preliminary filtration, fine filtration and/or ultra-fine filtration) of received sea-
30 water to produce filtered sea-water which can be further communicated to the aeration part 304b for further processing. Moreover, compressed air can be

provided to the aeration part 304b to drive the operation(s) of, for example, aerating and/or atomizing received filtered sea-water so that:

- (i) the air-liquid ratio of about 0.01 – 0.3 (weight ratio) can be achieved; and
- 5 (ii) an air bubble diameter of about 10 – 10,000 nanometers can be achieved.

By doing so, heat transfer relationship/characteristic between seawater and air can be improved. Thus separation between water and salt components in seawater can be made more efficient with application of a heating operation.

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The heating operation can be facilitated by the second driver portion 213b which can be powered by the second supply part 210. In one embodiment, prior to the operation of aeration (i.e., at the aeration part 304b), the seawater can be pre-heated via a heating operation which can be facilitated the second driver portion 213b (i.e., via the first heat exchanger part 213e and/or the second heat exchanger part 213f). The first heat exchanger part 213e and/or the second heat exchanger part 213f can correspond to, for example, a photovoltaic type heater and/or a hot-pump type heater. It is contemplated that the heating operation can facilitate efficiency in the aforementioned separation between water and salt components because heat energy can influence movement of water molecules.

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In this regard, the first treatment part 304 can be considered to be associated with one or more operations which can, for example, include a filtration operation (i.e., in association with the pre-treatment part 304a), an aerating operation (i.e., in association with the aeration part 304b) and/or a heating operation (i.e., in association with the second driver portion 213b).

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Moreover, it is appreciable that the first treatment part 304 can be considered to be both directly and indirectly powered by wind in the sense that:

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- In relation to being directly powered by wind, one or more portions (e.g., the aeration part 304b) of the first treatment part 304 can be

coupled to the second driver portion 213b which can be coupled to the second supply part 210. The second supply part 210 can be considered to be driven by harnessed wind energy from the wind power system 202. Hence one or more portions of the first treatment part 304 can be considered to be directly powered wind by virtue of the second supply part 210 being (directly) driven by harnessed wind energy from the wind power system 202.

- In relation to being indirectly powered by wind, one or more portions (e.g., the pre-treatment part 304a and/or the aeration part 304b) of the first treatment part 304 can be coupled to the third supply part 212. The third supply part 212 can be considered to have received energy converted from harnessed wind energy (i.e., electricity/power supplied by the wind power system 202 based on harnessed wind energy) in order to produce power/electricity to be supplied to one or more portions of the first treatment part 304 for facilitating/enabling one or more operations (e.g., filtration based operation(s), aerating and/or atomizing). Hence one or more portions of the first treatment part 304 can be considered to be indirectly powered wind by virtue of the third supply part 212 receiving converted energy (i.e., converted from harnessed wind energy) from the wind power system 202.

Appreciably, the first treatment part 304 can be considered to be capable of being both directly and indirectly powered by wind in a manner so as to process sea-water drawn in at the drawing part 302 to produce first stage treated sea-water.

The first stage treated sea-water can be communicated to the second treatment part 306 for further processing to produce a second stage treated sea-water as will be discussed in further detail hereinafter.

Specifically, the second treatment part 306 can be configured to receive and process the first stage treated sea-water in a manner to produce the second stage treated sea-water.

5 As shown, at the second treatment part 306, the first stage treated sea-water can be received by the pressure tank part 306a for processing by application of pressure followed by processing by ultrasonic atomization at the ultrasonic twin fluid atomization part 306b to produce the second stage treated sea-water.

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Further shown, the second treatment part 306 can be coupled to one or both of the first driver portion 213a and the second driver portion 213b. The first and second driver portions 213a/213b can be coupled to the second supply part 210. Specifically, the second supply part 210 can, for example, be
15 coupled to the ultrasonic generator 213c and/or the first heat exchanger part 213e. The ultrasonic atomization part 213d can be coupled to the pressure tank part 306a and/or the ultrasonic twin-fluid atomization part 306b. Moreover, the second heat exchanger part 213f can be coupled to the pressure tank part 306a.

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Operationally, the second supply part 210 (e.g., an electromechanical based supply part corresponding to an electricity generating system) can be (directly) driven by harnessed wind energy from the wind power system 202 to produce electricity/power for, for example, powering/driving the first driver portion 213a
25 and/or the second driver portion 213b. The first driver portion 213a can be configured to drive one or more operations associated with one or more portions of the second treatment part 306. The second driver portion 213a can be configured to driver one or more operations associated with one or more portions of the second treatment part 306.

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As mentioned earlier, the second heat exchanger part 213f can be coupled to the pressure tank part 306a. The ultrasonic atomization part 213d can be

coupled to one or both of the pressure tank part 306a and the ultrasonic twin fluid atomization part 306b. In this regard, the first driver portion 213a can be considered to be configurable to drive one or more operations (e.g., application of pressure) associated with the pressure tank part 306a. The
5 second driver portion 213b can be considered to be configurable to drive one or more operations (e.g., application of pressure and/or ultrasonic atomization) associated with one or both of the pressure tank part 306a and the ultrasonic twin fluid atomization part 306b.

10 At the pressure tank part 306a, the first stage treated sea-water can be driven by high pressure (i.e., application of pressure) and being driven by high pressure, molecules close to liquid (i.e., sea-water) surface can be subjected to imbalanced forces, causing large liquid molecules to evaporate and becoming steam. Accordingly, the density of liquid at the liquid surface can
15 be lower as compared to that within the liquid. High pressure can be kept within the range of 0.2 – 20 mpa.

Following the operation, at the pressure tank part 306a, of application of pressure, the operation, at the ultrasonic twin fluid atomization part 306b, of
20 ultrasonic atomization can be applied for further processing.

Concerning the operation of ultrasonic atomization, ultrasound waves can further move the liquid molecules for facilitating separation between water and salt components in sea-water. Sea-water can be atomized into droplets
25 having diameter(s) ranging 0.001 – 1.5 mm.

Therefore, at the ultrasonic twin fluid atomization part 306b, size of liquid (i.e., sea-water) droplets can be reduced. Moreover, air-bubbles can be introduced to improve air-liquid ratio within the seawater (a mixture of air and water
30 molecules) to facilitate separation between water and salt components in sea-water.

Therefore, it can be appreciated that the second stage treated sea-water can be produced based on a combination processing via the pressure tank part 306a and the ultrasonic twin fluid atomization part 306b, according to an embodiment of the disclosure.

5

In this regard, the second treatment part 306 can be considered to be associated with one or more operations which can, for example, include a pressure application operation (i.e., in association with the pressure tank part 306a), an ultrasonic atomization operation (i.e., in association with the ultrasonic twin fluid atomization part 306b) and/or a heating operation (i.e., in association with the second driver portion 213b).

As an option, the second stage treated sea-water can be re-introduced, as represented by arrow 312, to the processing part 106 for further processing by, for example, manner of heating (i.e., a heating operation in association with the second driver portion 213b).

Moreover, it is appreciable that the second treatment part 306 can be considered to be directly powered by wind in the sense that the second supply part 210, which can be associated with the second treatment part 306, is driven by harnessed wind energy from the wind power system 202 to, in turn, enable/facilitate the first and/or second driver portions 213a/213b to drive one or more operations (e.g., application of pressure, and/or ultrasonic atomization) associated with one or more portions (e.g., the pressure tank part 306a and/or the ultrasonic twin fluid atomization part 306b) of the second treatment part 306.

It is further appreciable that in view of the foregoing, direct powering can include a first direct powering type and a second direct powering type.

30

The first direct powering type can be associated with a non-cascaded type of direct powering where a supply part (e.g., the first supply part 208) driven by

harnessed wind energy from the wind power system 202 can be directly coupled to one or more portions (e.g., the drawing part 302) of the processing portion 106.

5 The second direct powering type can be associated with a cascaded type of direct powering where a supply part (e.g., the second supply part 210) driven by harnessed wind energy from the wind power system 202 can be indirectly coupled to one or more portions (e.g., the aeration part 304b and/or the pressure tank part 306a) of the processing portion 106. More specifically, in
10 regard to cascaded direct powering, a supply part (e.g., the second supply part 210) is coupled to at least one driver portion (e.g., the first driver portion 213a and/or the second driver portion 213b) which can, in turn, be coupled to one or more portions (e.g., the aeration part 304b and/or the pressure tank part 306a) of the processing portion 106. In this regard, direct powering can
15 be in a cascaded manner by way of coupling at least one supply part (e.g., the second supply part 210) to one or more portions of the processing portion 106 (e.g., the aeration part 304b and/or the pressure tank part 306a) via one or more driver portions (e.g., the first driver portion 213a and/or the second driver portion 213b).

20

Earlier mentioned, processed sea-water can be communicated from the processing portion 106 to the output portion 108 for further processing in a manner so as to produce one or more output products. Examples of an output product can include fresh-water and/or one or more recovered
25 materials (e.g., chemicals).

The aforementioned processed sea-water communicated from the processing portion 106 can correspond to the second stage treated sea-water, according to an embodiment of the disclosure.

30

In one embodiment, the second stage treated sea-water can be received by the flash distillation part 307 for distillation (e.g., single/multi-stage flash

distillation) to separate, for example, water and other components (e.g., salt) in sea-water.

5 After distillation (i.e., at the flash distillation part 307), further processing can be by manner of filtration at the filtration part 308 to produce the first output product 224 (e.g., fresh-water), according to an embodiment of the disclosure.

10 Moreover, after distillation (i.e., at the flash distillation part 307), further processing can be by manner of condensation at the condensation part 310 to produce the second output product 226 (e.g., a recovered material), according to an embodiment of the disclosure.

15 In view of the foregoing, it is appreciable that the present disclosure generally contemplates a system 100 which can be suitable for desalinating sea-water. At least a portion (i.e., the processing portion 106) of the system 100 can be one or both of directly and indirectly powered by wind.

20 Earlier mentioned, the system 100 can include a drawing part 302 where sea-water can be drawn in (i.e., into the system 100). The system 100 can further include a first treatment part 304 which can be configured to perform preliminary treatment (i.e., at the pre-treatment part 304a and/or the aeration part 304b) of sea-water drawn in so as to produce first stage treated sea-water. The system 100 can yet further include a second treatment part 306 which can be configured to receive and process first stage treated sea-water to produce second stage treated sea-water.

30 The second stage treated sea-water can be further communicated (i.e., to the output portion 108) for further treatment (e.g., processing by the flash distillation part 307 and one or both of the filtration part 308 and condensation part 310) for one or both of:

- 1) producing freshwater (i.e., in association with the aforementioned first output product 224); and

2) material recovery (i.e., in association with the aforementioned second output product 226).

5 The drawing part 302, the first treatment part 304 and/or the second treatment part 306 can be capable of being one or both of directly and indirectly powered by wind for operation (e.g., pumping to draw sea-water in, filtration based operation(s), aerating, atomizing, application of pressure, heating and/or ultrasonic atomization).

10 Moreover, each of the drawing part 302, the first treatment part 304 and the second treatment part 306 can be associated with at least one supply part for supplying power for operation.

15 For example, the drawing part 302 can be associated with the first supply part 208, the first treatment part 304 can be associated with one or both of the second and third supply parts 210/212, and the second treatment part 306 can be associated with the second supply part 210.

20 As discussed earlier, one or more of the supply parts (i.e., the first, second and/or third supply parts 208/210/212) can be one or both of directly and indirectly powered by wind so as to produce power to be supplied (i.e., to the drawing part 302, the first treatment part 304 and/or the second treatment part 306) for operation (e.g., pumping to draw sea-water in, filtration based operation(s), aerating, atomizing, application of pressure, heating and/or ultrasonic atomization).

25 Indirect powering by wind for operation can, for example, be by manner of harnessing wind for conversion into energy suitable for powering/driving the supply part (e.g., the third supply part 212) associable with the drawing part 302, the first treatment part 304 and/or the second treatment part 306.

Direct powering by wind for operation can, for example, be by manner of harnessing wind for powering/driving the supply part (e.g., the first supply part 208 and/or the second supply part 210) associable with the drawing part 302, the first treatment part 304 and/or the second treatment part 306.

5

In this regard, the system 100 can include a wind power system 202 which can be configured to harness wind energy for one or both of directly and indirectly powering/driving the drawing part 302, the first treatment part 304 and/or the second treatment part 306 for operation.

10

In one embodiment, the wind power system 202 can be coupled to the aforementioned supply part(s) (i.e., the first supply part 208, the second supply part 210 and/or the third supply part 212) which can be associated with the drawing part 302, the first treatment part 304 and/or the second treatment part 306 in a manner so as to be capable of one or both of directly and indirectly powering/driving the drawing part 302, the first treatment part 304 and/or the second treatment part 306.

15

For example, the supply part(s) associable with the drawing part 302 can correspond to the aforementioned first supply part 208, the supply part(s) associable with the first treatment part 304 can correspond to the aforementioned second supply part 210 and/or the third supply part 212, and the supply part(s) associable with the second treatment part 306 can correspond to the aforementioned second supply part 210.

20

The first supply part 208 can, for example, correspond to a mechanical based supply part such as a mechanical device which can be mechanically coupled to the wind power system 202 in a manner such that the mechanical device can be operationally driven by wind energy harnessed by the wind power system 202 in a manner so as to draw, at the drawing part 302, sea-water. As an option, geothermal hot water can further be drawn at the drawing part 302.

25

30

The second supply part 210 can, for example, correspond to an electromechanical based supply part such as an electricity generating system which can include a mechanical portion and a generator portion to which the mechanical portion can be coupled. The mechanical portion can be further
5 coupled to the wind power system 202 in a manner such that the mechanical portion can be operationally driven by wind energy harnessed by the wind power system 202 in a manner so as to, in-turn, drive the generator portion for producing electricity.

10 The third supply part 212 can, for example, correspond to an electrical based supply part. The electrical based supply part can, for example, correspond to an electrical device which can be electrically coupled to the wind power system 202. The wind power system 202 can be configured to produce electricity based on harnessed wind energy and communicate produced
15 electricity to the electrical device so as to power the electrical device for driving operation of, for example, the first treatment part 304.

In one embodiment, the system 100 can further include at least one driving portion (e.g., one or both of the aforementioned first driver portion 213a and
20 the second driver portion 213b) which can be configured to drive/power at least a portion of operation of one or both of the first treatment part 304 and the second treatment part 306. The second supply part 210 can be electrically coupled to the driving portion(s) so as to communicate produced electricity to the driving portion(s) so as to power/drive the driving portion(s)
25 for driving at least a portion of the operation of the first treatment part 304 and/or at least a portion of the operation of the second treatment part 306.

Referring to Fig. 4, a powering method 400 in association with the system 100 of Fig. 1 is shown, in accordance with an embodiment of the disclosure.
30 Specifically, the powering method 400 can relate to powering the system 100 in a manner such that one or more portions of the system 100 can be one or both of directly and indirectly powered by wind.

The powering method 400 can include one or both of a harnessing step 402 and a conversion step 404, according to an embodiment of the disclosure. The powering method 400 can further include one or both of a direct powering
5 step 406 and an indirect powering step 408, according to an embodiment of the disclosure. The powering method 400 can yet further include a cascaded powering step 410, according to an embodiment of the disclosure.

10 With regard to the harnessing step 402, wind energy can be harnessed at the source portion 102.

With regard to the conversion step 404, harnessed wind energy can be converted to an energy type such as electrical power at the source portion
15 102.

With regard to the direct powering step 406, harnessed wind energy (e.g., in the form of translated mechanical energy) can be directly communicated to the power portion 104 in association with the aforementioned direct powering by wind for operation. Specifically, earlier mentioned, direct powering by wind
20 for operation can, for example, be by manner of harnessing wind energy for driving at least a portion of the power portion 104. The portion(s) of the power portion 104 can be driven (i.e., by manner of harnessed wind energy) in a manner so as to produce energy suitable for powering one or more portions of the processing portion 106 in a manner so as to enable one or more
25 operations associated with the processing portion 106.

With regard to the indirect powering step 408, harnessed wind energy can be indirectly communicated to the power portion 104 in association with the aforementioned indirect powering by wind for operation. Harnessed wind
30 energy can be indirectly communicated in the sense that harnessed wind energy can be converted (i.e., at the conversion step 404) into a suitable energy type (e.g., electrical power) which can, in turn, be communicated to the

power portion 104. Specifically, earlier mentioned, indirect powering by wind for operation can, for example, be by manner of harnessing wind energy for conversion into an energy type suitable (e.g., electrical power) for powering/driving at least a portion of the power portion 104. One or more portions of the power portion 104 can, in turn, be configured to power one or more portions of the processing portion 106 in a manner so as to enable one or more operations associated with the processing portion 106.

With regard to the cascaded powering step 410, in association with the aforementioned cascaded direct powering, a supply part associated with the power portion 104 (e.g., the second supply part 210) driven by harnessed wind energy from the wind power system 202 can be indirectly coupled to one or more portions (e.g., the aeration part 304b and/or the pressure tank part 306a) of the processing portion 106. More specifically, as earlier mentioned in regard to cascaded direct powering, a supply part (e.g., the second supply part 210) can be coupled to at least one driver portion (e.g., the first driver portion 213a and/or the second driver portion 213b) which can, in turn, be coupled to one or more portions (e.g., the aeration part 304b and/or the pressure tank part 306a) of the processing portion 106. In this regard, direct powering can be in a cascaded manner by way of coupling at least one supply part (e.g., the second supply part 210) to one or more portions of the processing portion 106 (e.g., the aeration part 304b and/or the pressure tank part 306a) via one or more driver portions (e.g., the first driver portion 213a and/or the second driver portion 213b).

In the foregoing manner, various embodiments of the disclosure are described for addressing at least one of the foregoing disadvantages. It should be appreciated by the person skilled in the art that variations and combinations of features described above, not being alternatives or substitutes, may be combined to form yet further embodiments.

In one example, the second supply part 210 can be configured to store generated electrical power (i.e., the second supply part 210 can further include a storage portion coupled to the generator portion to store electricity generated by the generator portion). Therefore, in addition to the third supply part 212 being (directly) coupled to the wind power system 202, the third supply part 212 can be further coupled to the second supply part 210 which can serve as backup supply (i.e., in association with the storage portion) to the third supply part 212 in the event of occurrence of disruption(s) (e.g., absence of wind) of supply from the wind power system 202. Therefore, the present disclosure further contemplates inter-coupling within the power portion 104 where one or more supply parts can be coupled to one or more other supply parts (e.g., the second supply part 210 can be further coupled to one or both of the first supply part 208 and the third supply part 212).

15 The present disclosure contemplates that although (strong) winds can be used to generate high speed shear electric field and magnetic field to aid in the processes of evaporation and improve desalination efficiency (i.e., high speed shear generated high frequency magnetic field and electric field can be used to break water molecules of seawater), instability should be accounted for (i.e., due to disruption in supply of wind/ variance in wind speed(s)). Therefore, the second supply part 210 (i.e., in view of stored electricity at the storage portion) can, in one embodiment, serve as basis for backup supply and/or maintain stable supply in the system 100.

25 In another example, it was earlier discussed that the first supply part 208 can be mechanically coupled to the wind power system 100. It is further contemplated that the first supply part 208 (e.g., an electrical pump) can be electrically coupled to the wind power system 100 and/or the second supply part 210. In this regard, the present disclosure contemplates that one or both of mechanical coupling and electrical coupling to the first supply part 208 can be possible.

Moreover, various embodiments of the disclosure are, as mentioned earlier, described for addressing at least one of the foregoing disadvantages. It should be appreciated that such embodiments are intended to be encompassed by the following claims, and are not to be limited to specific
5 forms or arrangements of parts so described and it will be apparent to one skilled in the art in view of this disclosure that numerous changes and/or modification can be made, which are also intended to be encompassed by the following claims.

Claims:

1. A system suitable for desalinating sea-water, at least a portion of the system being at least one of directly and indirectly powered by wind, the
5 system comprising:

a drawing part where sea-water is drawn in

a first treatment part configured to perform preliminary treatment of sea-water drawn in to produce first stage treated sea-water;

10 a second treatment part configured to receive first stage treated sea-water to produce second stage treated sea-water capable of being further communicated for further treatment for at least one of producing freshwater and recovery of material,

15 wherein each of the drawing part, the first treatment part and the second treatment part is capable of being at least one of directly and indirectly powered by wind for operation.

2. The system as in claim 1,

20 wherein each of the drawing part, the first treatment part and the second treatment part is associable with at least one supply part for supplying power for operation,

25 wherein the supply part for each of the drawing part, the first treatment part and the second treatment part is capable of being at least one of directly and indirectly powered by wind so as to produce power to be supplied for operation.

3. The system as in claim 2,

30 wherein indirect powering by wind for operation is by manner of harnessing wind for conversion into energy suitable for powering the supply part associable with at least one of the drawing part, the first treatment part and the second treatment part, and

wherein direct powering by wind for operation is by manner of harnessing wind for driving the supply part associable with at least one

of the drawing part, the first treatment part and the second treatment part.

4. The system as in claim 1, further comprising:

5 a wind power system configurable to harness wind energy for at least one of directly and indirectly powering each of the drawing part, the first treatment part and the second treatment part for operation.

5. The system as in claim 4,

10 wherein each of the drawing part, the first treatment part and the second treatment part is associable with at least one supply part for supplying power for operation,

wherein the wind power system is coupled to the supply part associable with each of the drawing part, the first treatment part and
15 the second treatment part in a manner so as to be capable of at least one of directly and indirectly powering each of the drawing part, the first treatment part and the second treatment part.

6. The system as in claim 5,

20 wherein the drawing part is associable with a first supply part, wherein the first treatment part is associable with at least one of a second supply part and a third supply part,

wherein the second treatment part is associable with the second supply part, and

25 wherein the first supply part is a mechanical based supply part, the second supply part is an electromechanical based supply part and the third supply part is an electrical based supply part.

7. The system as in claim 6, wherein the mechanical based supply part
30 corresponds to a mechanical device capable of being mechanically coupled to the wind power system in a manner such that the mechanical device is

operationally driven by wind energy harnessed by the wind power system in a manner so as to draw, at the drawing part, sea-water.

8. The system as in claim 6,

5 wherein the electromechanical based supply part corresponds to an electricity generating system,

wherein the electricity generating system comprises a mechanical portion and a generator portion, the generator portion being coupled to the mechanical portion.

10 wherein the mechanical portion is further coupled to the wind power system in a manner such that the mechanical portion is operationally driven by wind energy harnessed by the wind power system in a manner so as to, in-turn, drive the generator portion for producing electricity.

15

9. The system as in claim 8, further comprising:

at least one driving portion for driving at least a portion of operation of at least one of the first treatment part and the second treatment part,

20

wherein the electricity generating system is capable of being electrically coupled to the driving portion so as to communicate produced electricity to the driving portion so as to power the driving portion for driving at least one of:

at least a portion of the operation of the first treatment part; and

25

at least a portion of the operation of the second treatment part.

10. The system as in claim 6,

30 wherein the electricity based supply part corresponds to an electrical device which is capable of being electrically coupled to the wind power system,

wherein the wind power system is capable of producing electricity based on harnessed wind energy and communicating

produced electricity to the electrical device so as to power the electrical device for driving operation of the first treatment part.